

Phase I Toxicity Identification Evaluation (TIE)

Preliminary Assessment

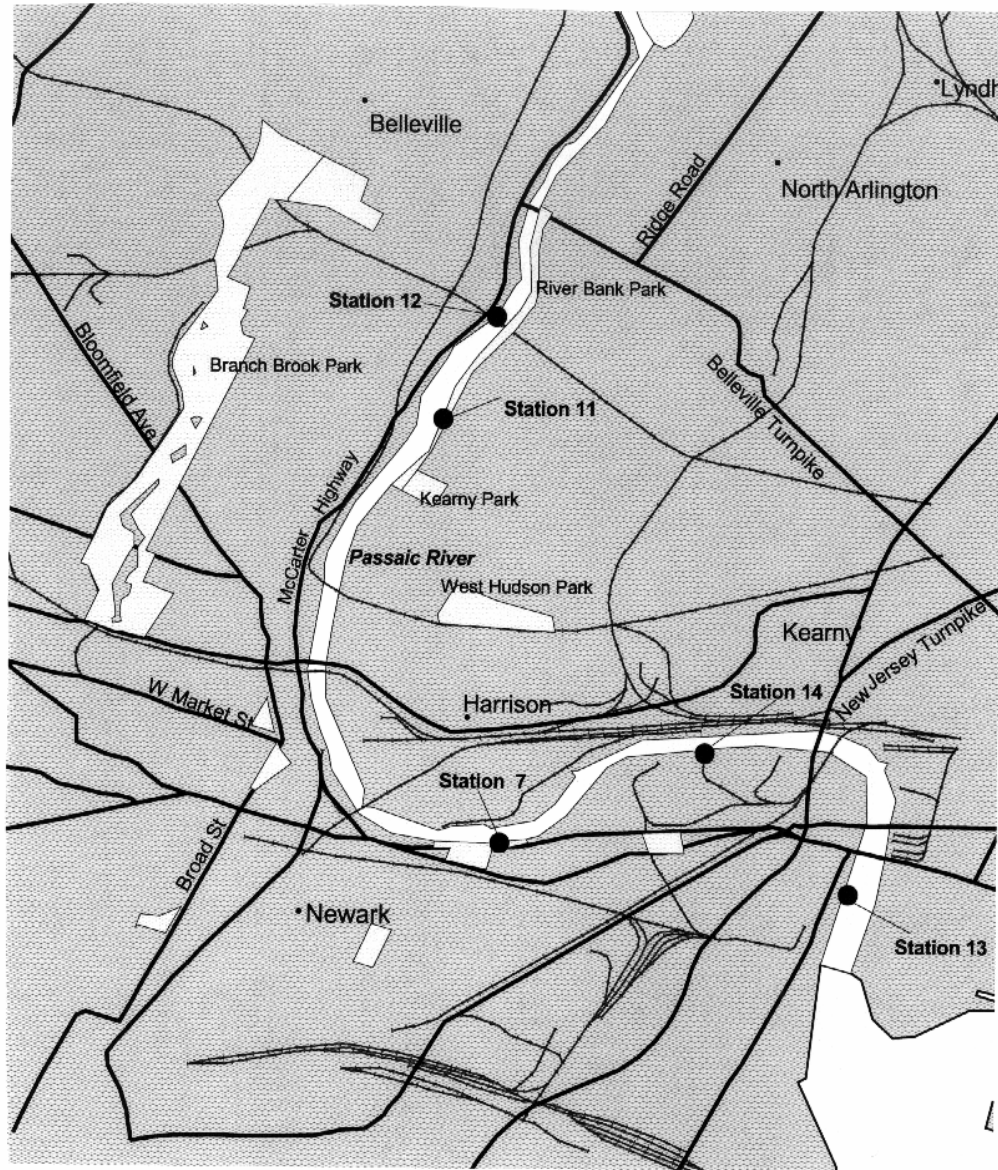
Objectives

- Determine if one or more chemical classes appear responsible for sediment toxicity to benthic invertebrates in the PRSA
- Perform an investigation to supplement the sediment quality triad (SQT) assessment being performed under the CERLCA RI/FS

Field Sampling Methods

- July 2000 sampling event
- Five stations in the PRSA — corresponding to ESP stations 7, 11, 12, 13, and 14
- Stations selected for apparent differences in predominant chemical contaminant mixtures
- Surface sediment samples collected

Locations of TIE Sample Stations



LEGEND

- ~ Roads
- x- Railroad
- ▨ Parks

Customized Stainless Steel Mixer Used to Homogenize PRSA Sediment Samples



Laboratory Methods

- Followed USEPA (1996) Phase I Marine TIE procedures — pore water manipulations
- Contaminant chemistry analyses (comparable to CERCLA RI/FS) performed on sediment and pore water samples
- Sediment and pore water toxicity tests using the amphipod *Ampelisca abdita*
- Additional Microtox[®] pore water toxicity tests

TIE Methods Summary

- Initial and baseline toxicity tests
- Multiple pore water manipulations – results compared to baseline
- Five pore water dilutions for each manipulation (0, 25%, 50%, 75%, 100%)
- Dose-response relationships examined – LC50s calculated

Summary of Phase I TIE Manipulations Performed on Pore Water Samples from Each Station

Manipulation Type	Chemical Focus of Manipulation
Filtration	To remove toxicity associated with particulate-bound toxicants
Aeration	To remove toxicity associated with volatile organic compounds, sulfides, and ammonia
Ethylenediaminetetraacetic acid (EDTA) chelation	To remove toxicity associated with metals
Sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$) treatment	To remove toxicity associated with oxidants (i.e., chlorine), and some metals
Solid-phase extraction (SPE) through a C-18 column/follow-up elution	To remove toxicity associated with non-polar organic compounds such as pesticides, PCDD/Fs, and PAHs
Graduated pH adjustment to pH 7, pH <i>i</i> , and pH 9	To remove pH-dependent toxicants such as ammonia and hydrogen sulfide
SPE through a cation exchange resin/follow-up elution	To remove toxicity associated with divalent metals
<i>Ulva lactuca</i> treatment	To remove toxicity associated primarily with ammonia, with some secondary removal of hydrogen sulfide and organic compounds

Results

- Percent amphipod survival in sediments was zero or near zero in each sample
- Pore water toxicity to amphipods varied between stations in initial and baseline tests
- No toxicity observed during baseline toxicity test (pore water) at Station 11
- Some post-manipulation toxicity tests had either high control mortality or no dose-response relationship

Comparison of Initial and Baseline Study Results Using *Ampelisca abdita*

Station	Whole Sediment 10 days (% survival)	Pore Water (48 hours LC50)	
		Initial	Baseline ^a
7	0	24	29
11	0	83	>100
12	0	73	<13
13	3	14	33
14	0	35	75

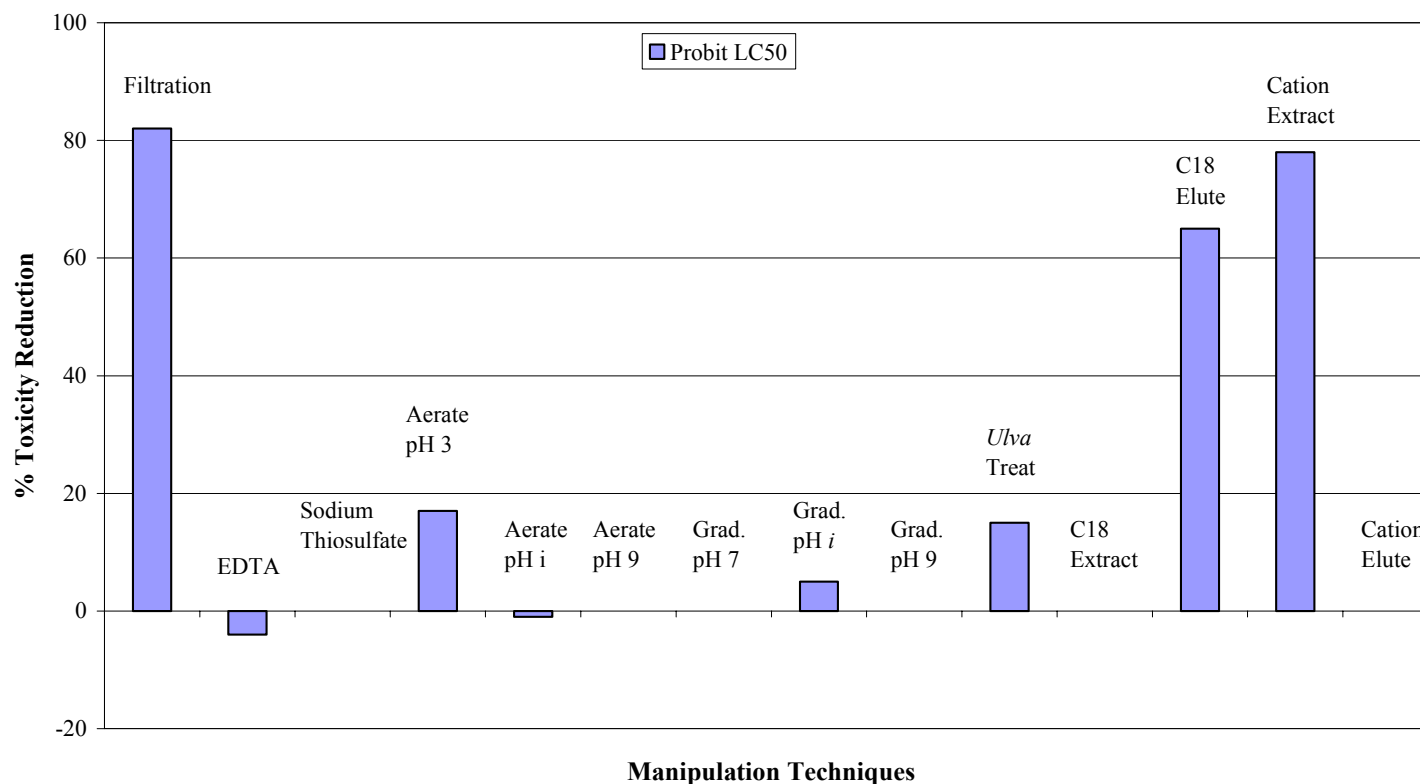
Notes:

^a Baseline tests conducted in conjunction with TIE manipulation samples (48 hours after initial tests).

Results

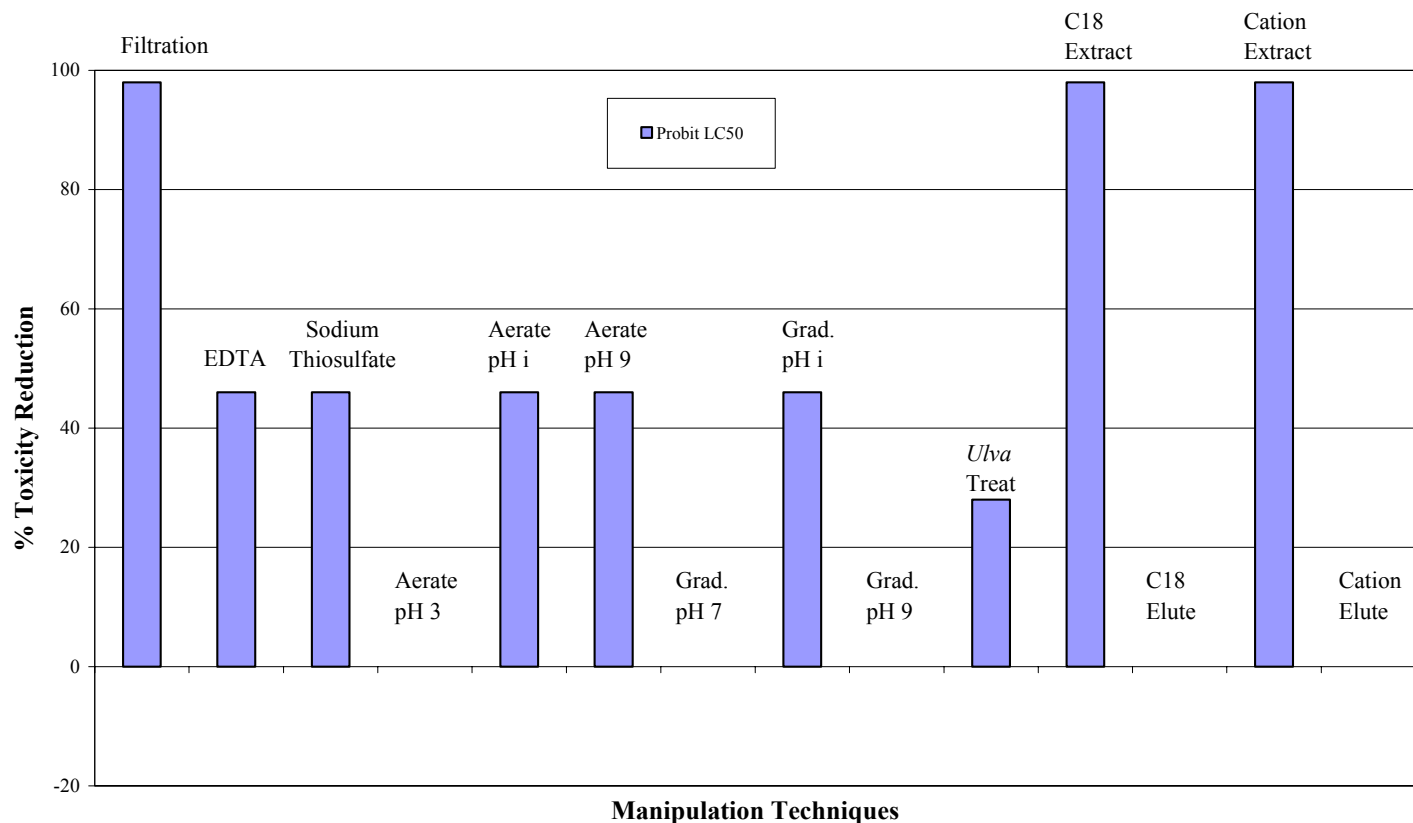
- No toxicity in Microtox[®] tests in pore water samples from Stations 11, 13, and 14 — low toxicity at stations 7 and 12
- Suggests that the following are not likely toxicants:
 - Oxidants
 - Dissolved phase metals
 - Dissolved phase neutral organics

Comparison of 48-Hour Toxicity Study Results for Phase I TIE Manipulations for Station 7 Based on LC50 Analysis



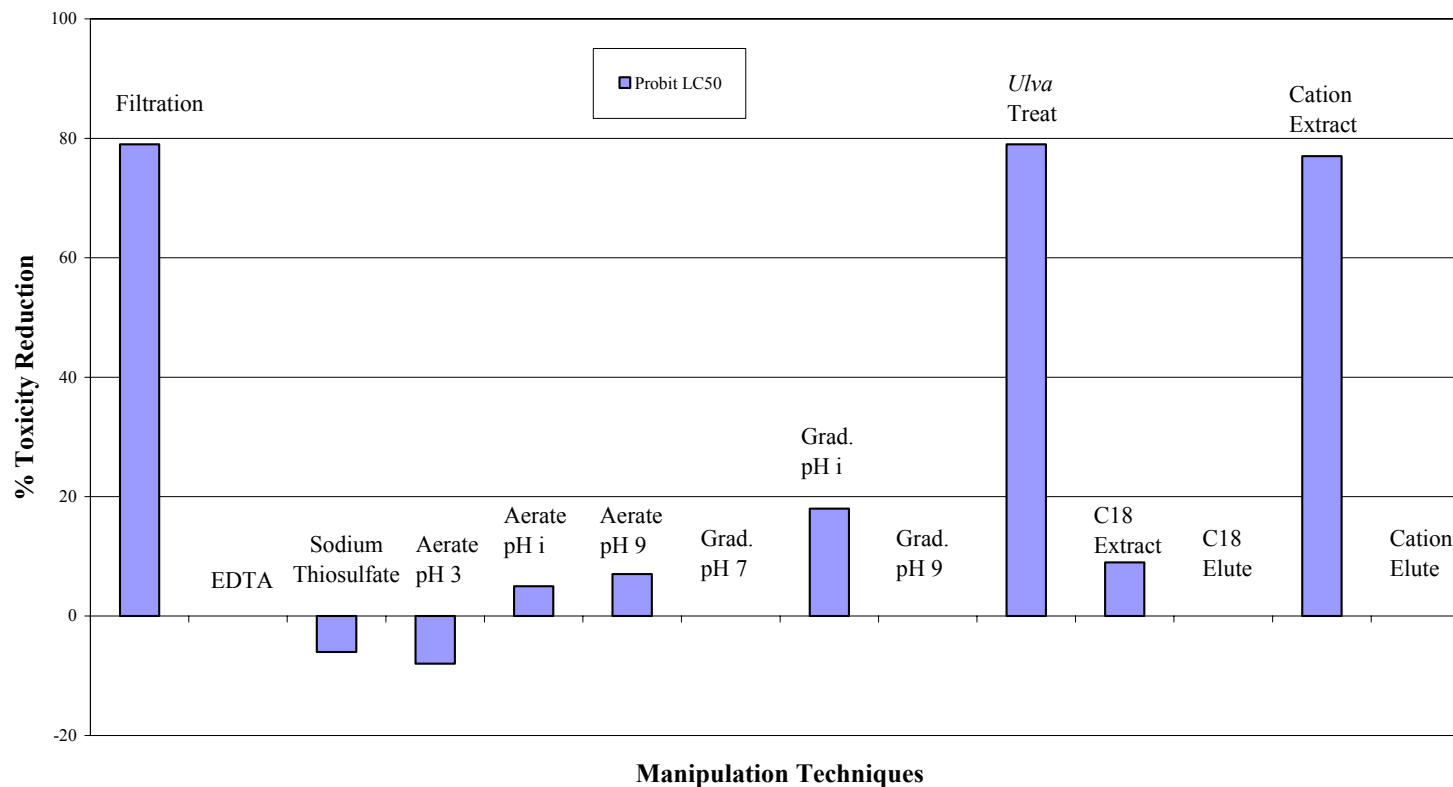
Manipulated fraction results compared to baseline results.

Comparison of 48-Hour Toxicity Study Results for Phase I TIE Manipulations for Station 12 Based on LC50 Analysis



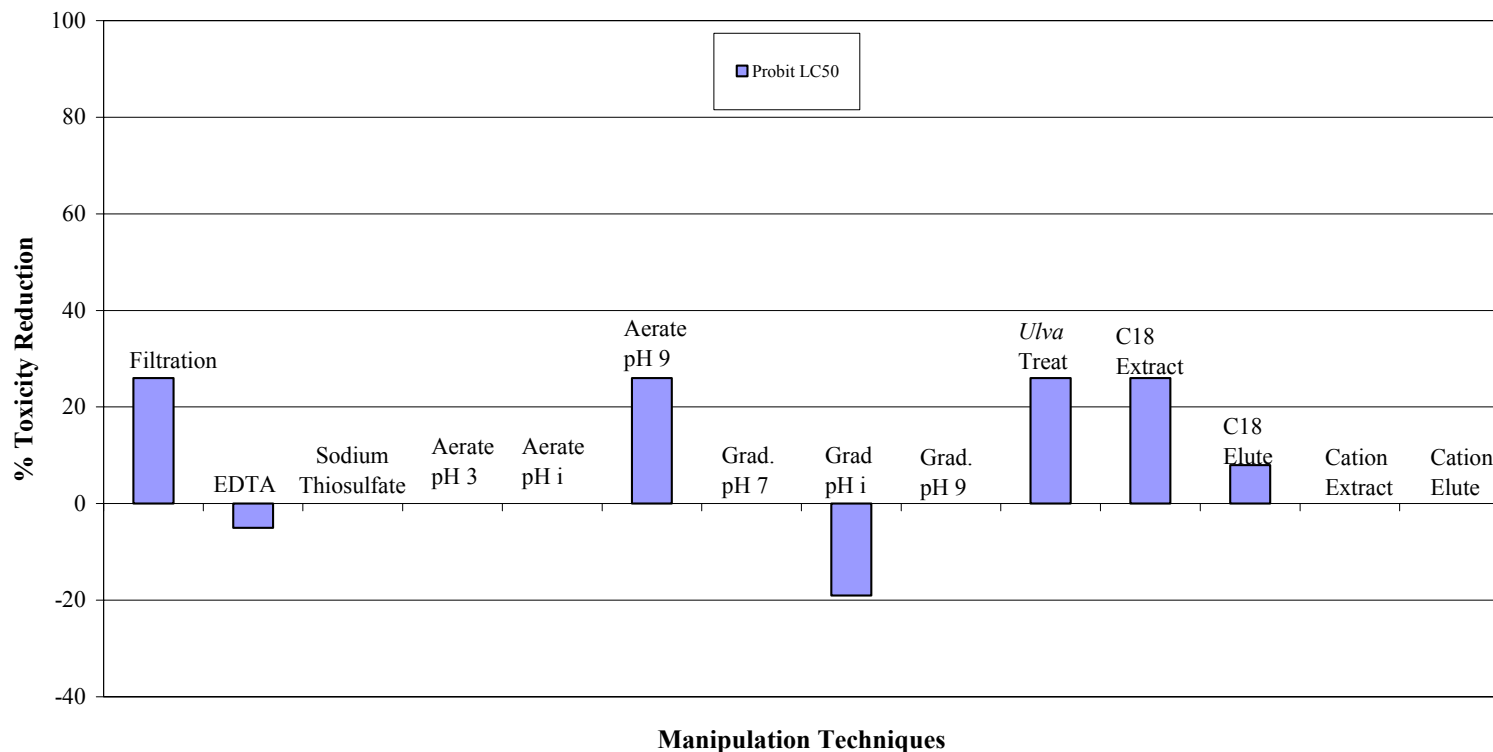
Manipulated fraction results compared to baseline results.

Comparison of 48-Hour Toxicity Study Results for Phase I TIE Manipulations for Station 13 Based on LC50 Analysis



Manipulated fraction results compared to baseline results.

Comparison of 48-Hour Toxicity Study Results for Phase I TIE Manipulations for Station 14 Based on LC50 Analysis



Manipulated fraction results compared to baseline results.

TIE Results – Preliminary Interpretation

Manipulation	Key Chemical Class	Results			
		Station 7	Station 12	Station 13	Station 14
Filtration	Particles	++	++	++	+
Aeration	VOCs/Ammonia/Sulfides	-	+	+	+
EDTA Chelation	Metals	-	+	NR	-
Na ₂ S ₂ O ₃ Treatment	Metals	NR	+	-	NR
pH Adjustments	Ammonia/Sulfides	-	+	+/-	-
C-18 SPE	Nonpolar Organic Compounds	NR	++	+	+
Cation Exchange SPE	Metals	++	++	++	NR
<i>Ulva lactuca</i> Treatment	Ammonia/Sulfides	+	+	++	+
TIE Interpretation Regarding Possible Causes of Toxicity:		1. Particle-associated toxicity	Particle-associated nonpolar organic compounds	Particle-associated nonpolar organic compounds	Particle-associated nonpolar organic compounds
		2.	Particle-associated metals	Particle-associated metals	Ammonia
		3.	Ammonia	Ammonia	Low response = other contributors

Notes:

++ = indicates strong toxicity reduction.

+ = indicates low to moderate toxicity reduction.

- = indicates ineffective toxicity reduction.

NR = no dose-response relationship or high control mortality occurred in this manipulation.



Preliminary Conclusions

- Toxicity characteristics at stations exhibiting baseline toxicity were consistent with particle-associated chemicals
 - Toxicity removed primarily by filtration
 - Sediment tests had higher toxicity than pore water tests
 - Microtox[®] toxicity low or zero
- Ammonia may be a seasonal contributor to toxicity

Next Steps

- Evaluate TIE results with respect to sediment and pore water chemistry analyses (e.g., toxic units assessment)
- Final interpretation
- Integration with SQT